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Hasegawa et al.

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(54) **ELECTRICAL CONNECTOR WITH TWO SIGNAL AND TWO GROUNDING CONTACT ENDS ALTERNATELY POSITIONED IN TWO ROWS**

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(30) **Foreign Application Priority Data**

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H01R 13/6471 (2011.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H01R 13/6597*** (2013.01); ***H01R 12/71*** (2013.01); ***H01R 13/646*** (2013.01); ***H01R 13/6471*** (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/646–13/648; H01R 13/6471
USPC 439/607.28, 101, 108, 607.05
See application file for complete search history.

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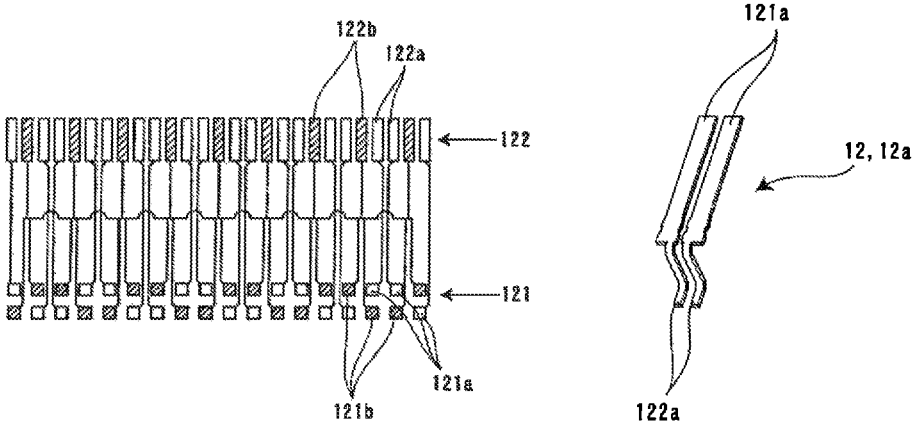
(57) **ABSTRACT**

An electrical connector is disclosed having a plurality of contacts. The plurality of contacts includes contact ends positioned in two rows and terminating ends positioned in one row. A first grouping of the plurality of contacts includes units of two differential signal carrying contacts having signal carrying contact ends connected to two signal terminating ends on a one to one ratio. The first grouping also includes grounding contacts positioned adjacent to the signal carrying contacts, and having grounding contact ends connected to grounding terminating ends with a ratio of the number of grounding contact ends being greater than or equal to the number of grounding terminating ends.

17 Claims, 17 Drawing Sheets



(51) **Int. Cl.**
H01R 12/71 (2011.01)
H01R 13/646 (2011.01)

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Fig. 1

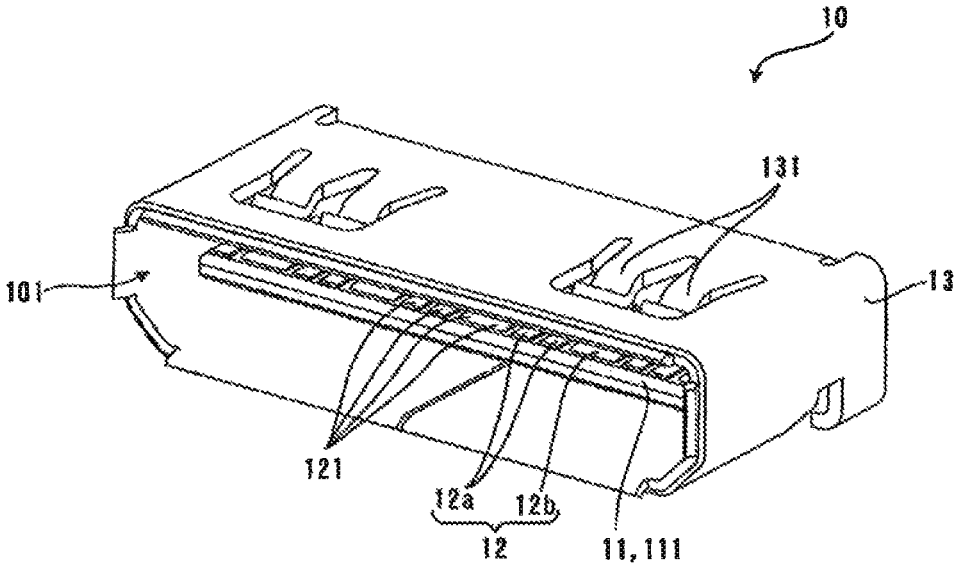


Fig. 2

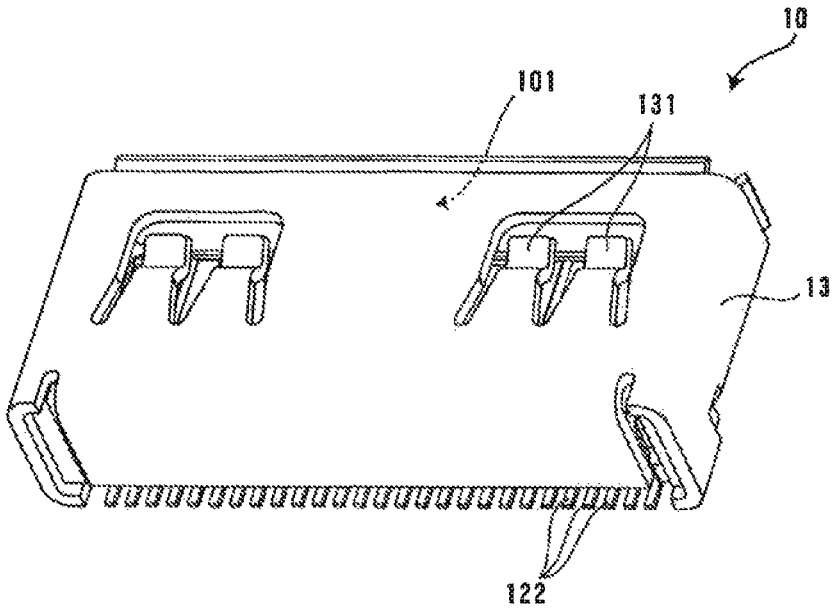


Fig. 3

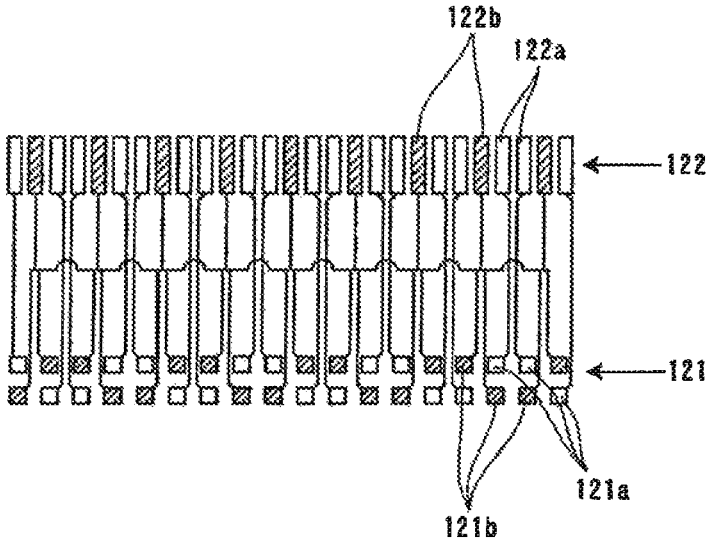


Fig. 4

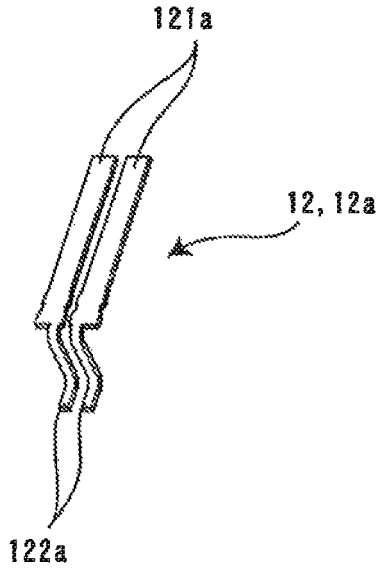


Fig. 5

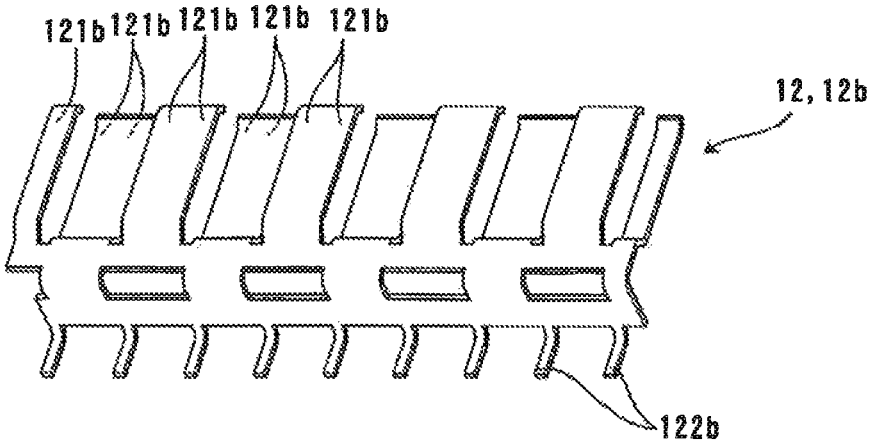


Fig. 6

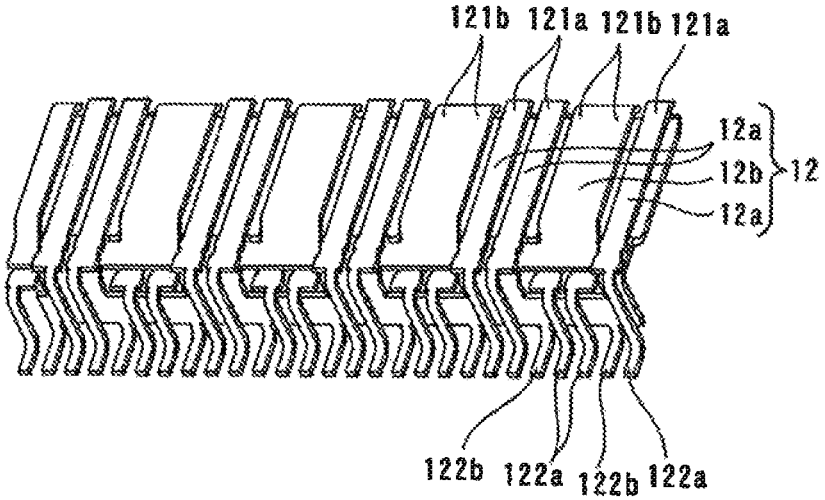


Fig. 7

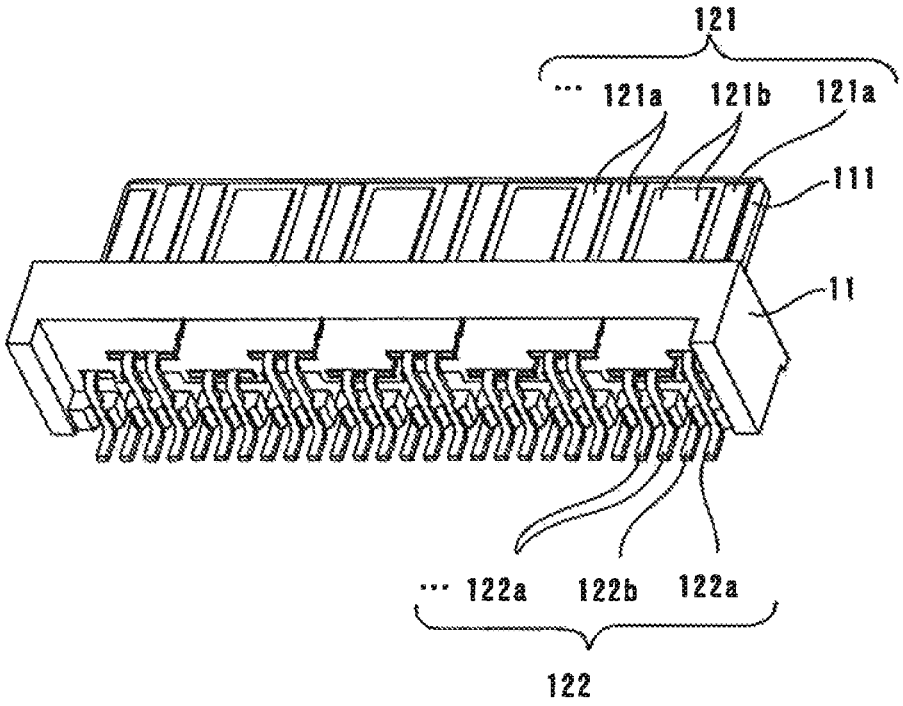


Fig. 8

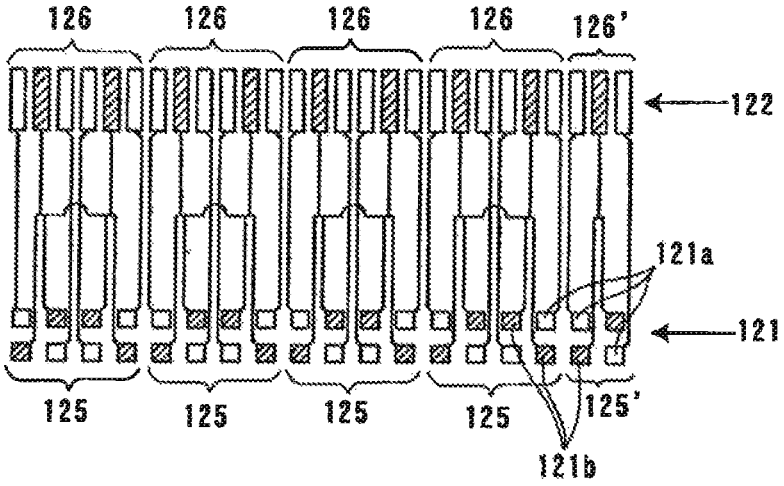


Fig. 9

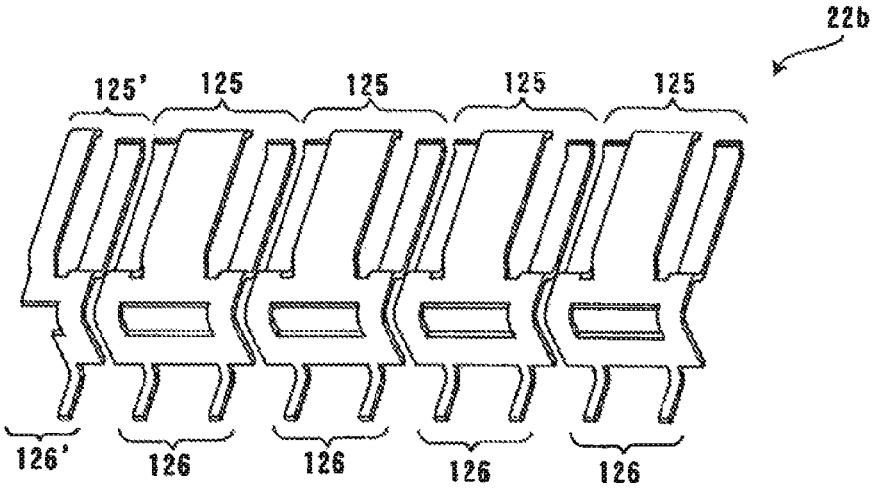


Fig. 10

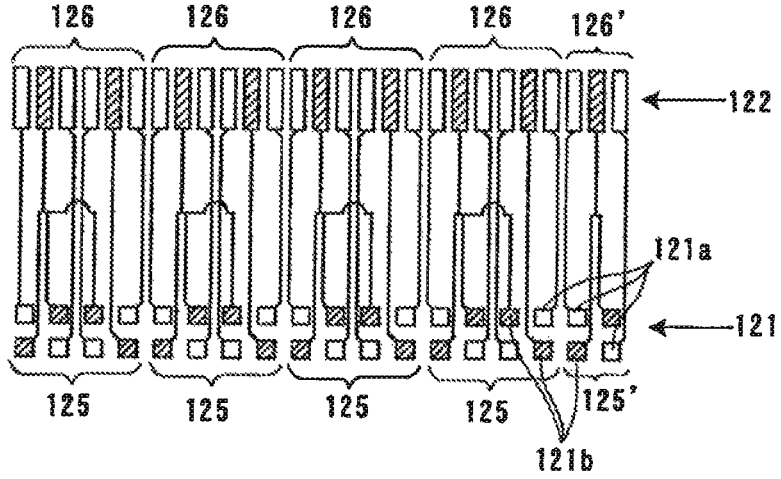


Fig. 11

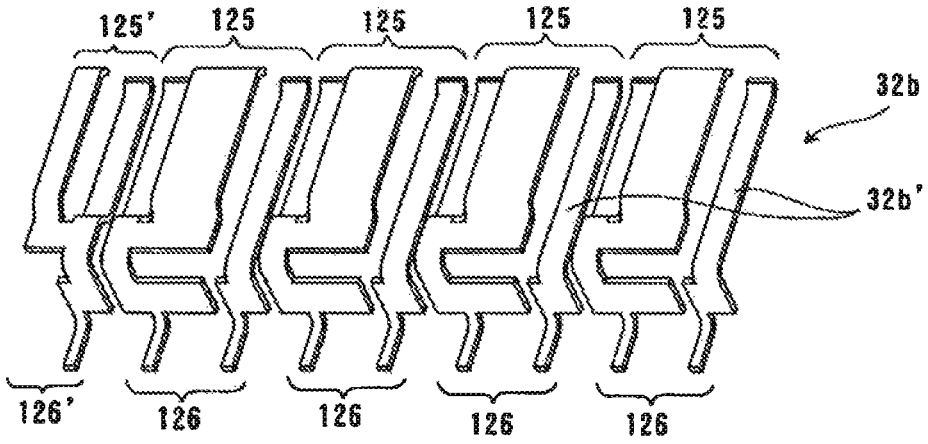


Fig. 12

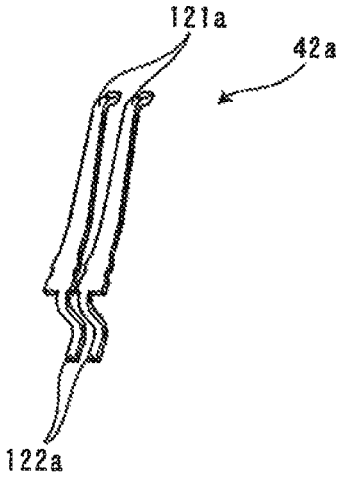


Fig. 13

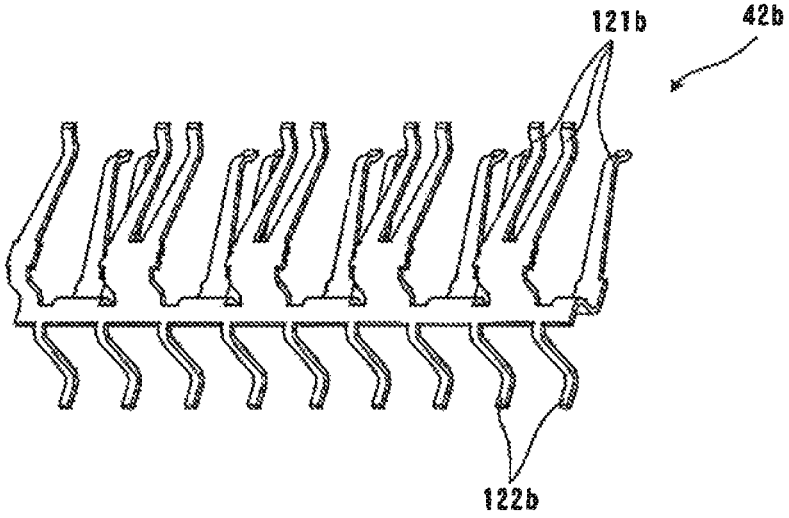


Fig. 14

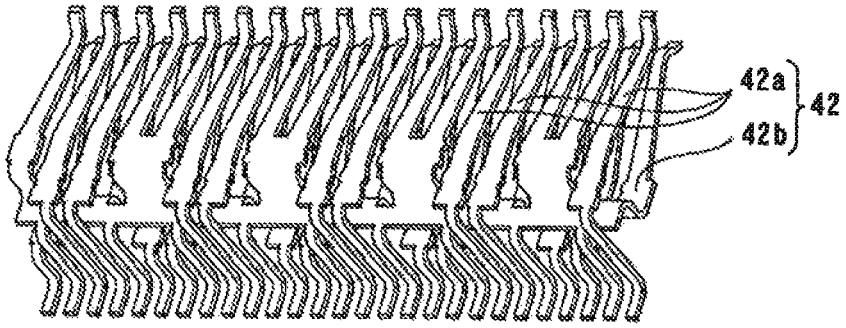


Fig. 15

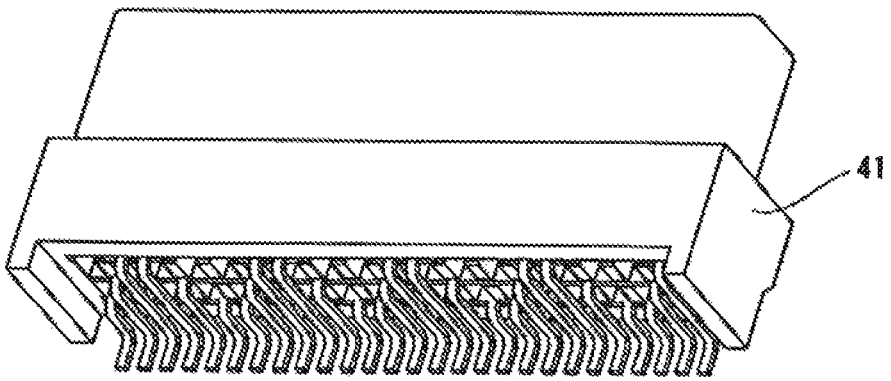


Fig. 16

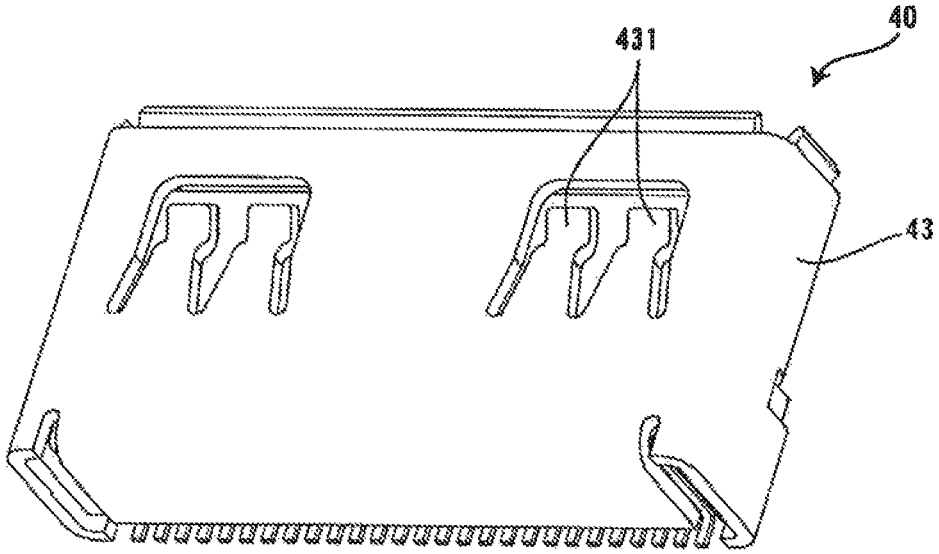


Fig. 17

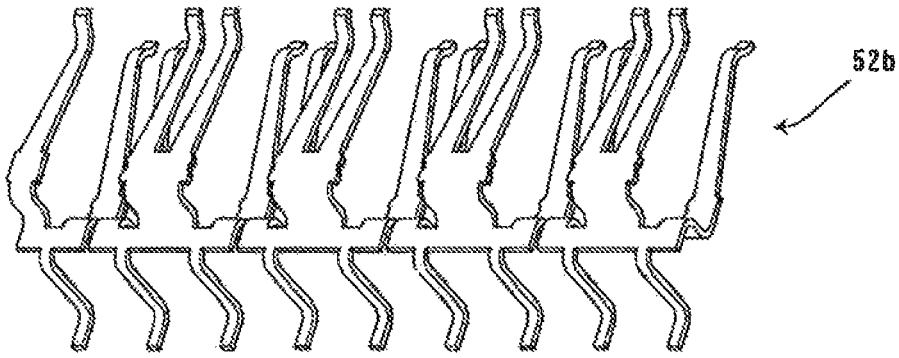
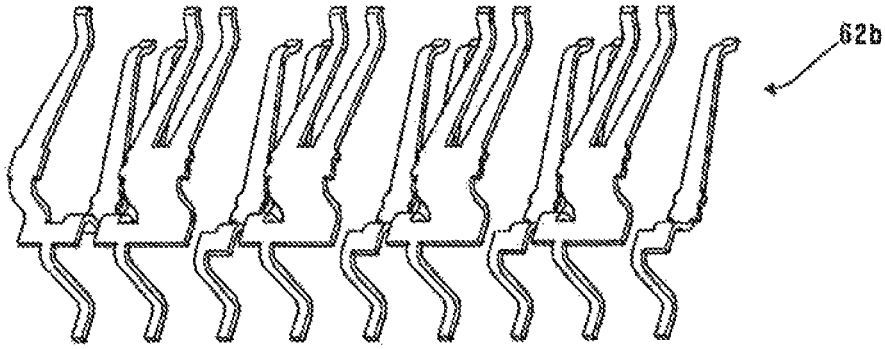


Fig. 18



ELECTRICAL CONNECTOR WITH TWO SIGNAL AND TWO GROUNDING CONTACT ENDS ALTERNATELY POSITIONED IN TWO ROWS

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of PCT Application No. PCT/JP2013/052181, dated Jan. 31, 2013, and claiming priority to Japanese Patent Application No. 2012-92014, dated Apr. 13, 2012.

FIELD OF THE INVENTION

The invention generally relates to an electrical connector, and more specifically to an electrical connector that transmits a differential signal.

BACKGROUND

Japanese Patent Application No. 2010-157505A discloses a conventional electrical connector that transmits a differential signal. The connector has a plurality of contacts having contact end portions positioned in two rows along a mating face, and contact terminating portions extending in one row out of a circuit board mounting side of the connector. The contact terminating portions extend in one row, because if the contacts terminating portions on circuit board mounting side were in a two row configuration similar to the contact end portions on the mating end, inspection or repair of soldering of an inner row would be obstructed by an outer row. Therefore, particularly in surface mounted connectors, the contact terminating portions are conventionally arranged in one row.

However, since all of the contact terminating portions extend in one row, the width of the electrical connector will be longer than a connector having the contact terminating portions extending in a two row configuration from the circuit board mounting side. The width presents a limitation in designing electrical connectors that are smaller in size. There is a need for a connector having a two-row contact end portion configuration on a mating face of the connector, and a row of contact terminating portions extending from the circuit board mounting with a smaller width, while not obstructing the inspection or repair of soldering.

SUMMARY

An electrical connector has a plurality of contacts. The plurality of contacts includes contact ends positioned in two rows and terminating ends positioned in one row. A first grouping of the plurality of contacts includes units of two differential signal carrying contacts having signal carrying contact ends connected to two signal terminating ends on a one to one ratio. The first grouping also includes grounding contacts positioned adjacent to the signal carrying contacts, and having grounding contact ends connected to grounding terminating ends with a ratio of the number of grounding contact ends being greater than or equal to the number of grounding terminating ends.

BRIEF DESCRIPTION OF DRAWINGS

The invention will now be described by way of example, with reference to the accompanying Figures, of which:

FIG. **1** is a perspective view of a mating face of an electrical connector;

FIG. **2** is a perspective view of a rear face of the electrical connector of FIG. **1**;

FIG. **3** is a configuration diagram of a relationship of connection between first contact members and second contact members of the electrical connector of FIG. **1**;

FIG. **4** is a perspective view showing differential-signal carrying contacts of the electrical connector in FIG. **1**;

FIG. **5** is a perspective view of a ground-connection contact of the electrical connector in FIG. **1**;

FIG. **6** is a perspective view of a combination of the differential-signal carrying contacts in FIG. **4** and the ground-connection contact in FIG. **5**;

FIG. **7** is a perspective view of a contact housing having the contacts in FIG. **6**;

FIG. **8** is a configuration diagram of a relationship of connection between first contact members and second contact members in an electrical connector;

FIG. **9** is a perspective view of ground-connection contacts of the electrical connector in FIG. **8**;

FIG. **10** is a diagram illustrating a relationship of connection between first contact members and second contact members in an electrical connector;

FIG. **11** is a perspective view of ground-connection contacts of the electrical connector in FIG. **8**;

FIG. **12** is a perspective view of differential-signal carrying contacts of an electrical connector;

FIG. **13** is a perspective view of a ground-connection contact of the electrical connector in FIG. **12**;

FIG. **14** is a perspective view of a combination of the differential-signal carrying contacts in FIG. **12** and the ground-connection contact in FIG. **13**;

FIG. **15** is a rear perspective view of a contact housing having the contacts in FIG. **14**;

FIG. **16** is a rear perspective view of the electrical connector in FIG. **12**;

FIG. **17** is a perspective view of ground-connection contacts of an electrical connector; and

FIG. **18** is a perspective view of ground-connection contacts of an electrical connector.

DETAILED DESCRIPTION OF THE EMBODIMENT(S)

An electrical connector **10** has a plurality of contacts **12** positioned in a housing **11**. The housing **11** is enclosed by a shield **13** made of metal. Cantilevered arm members **131** are formed in the shield **13**. The arm members **131** are brought into contact with a shield of a complimentary mating connector (not shown) mated with the electrical connector **10** to retain shielding performance, and press against the mating connector to secure the mating connector and ensure the mating connector remains connected. In an embodiment, the housing **11** is made of resin, and the shield **13** is made of metal.

In the embodiment of FIG. **1**, the contact **12** includes contact ends **121**. The contact ends **121** are positioned inside a mating connector receiving opening **101** of the shield **13**, and on a tongue **111** of the housing **11** (also see FIG. **7**). The mating connector receiving opening **101** is disposed on a mating end of the electrical connector **10**. The contact ends **121** are positioned on the tongue **111**. The contact ends **121** are brought into contact with a complimentary contact of the mating connector.

The contacts **12** include a signal carrying contact **12***a* having a narrower plate-like portion and a first grounding contact **12***b* having a wider plate-like portion on a mating end. The narrower signal carrying contacts **12***a* are brought into con-

tact with one contact of the mating connector, while the wider first grounding contacts **12***b* are brought into contact with two contacts of the mating connector. For example, one contact end **121** may contact each narrower plate-like portion, while two contact ends **121** may be present for each wider plate-like portion, such that the two contact ends **121** are both positioned on the wider plate-like portion.

In the embodiment in FIG. **1**, while only an upper surface of the tongue **111** is shown having the contacts **12** positioned thereon, the contacts **12** are also positioned on a lower surface of the tongue **111**. In the embodiment, the contacts **12** are positioned in two rows along opposite surfaces of the tongue **111**.

In the embodiment of FIG. **2**, the contact **12** includes a contact terminating end **122**. The contact terminating ends **122** are surface-mounted on a circuit board (not shown). As shown in FIG. **2**, the contact terminating ends **122** are positioned in one row.

In the embodiment of FIG. **3**, the contact ends **121** are positioned in two rows along the mating end of the connector **10**, and the contact terminating ends **122** are position in one row along a circuit board facing end of the connector **10**.

The contact ends **121** include white-square signal contact ends **121***a* that carry signals. The signal contact ends **121***a* are positioned as pairs of adjacent signal contact ends **121***a* to carry a differential signal. However, the white signal contact ends **121***a* positioned at both right and left ends have no adjacent signal contact ends **121***a* to be paired with, and are therefore are optionally available to be used for carrying a low-speed signal other than a differential signal, or as a ground terminal, a power terminal, or other similar applications known to those of ordinary skill in the art. The differential-signal carrying signal contact ends **121***a*, excluding the white signal contact ends **121***a* positioned at both the right and left ends, are referred to as a first grouping of contact ends **121**.

The hatched-square grounding contact ends **121***b* are ground-connection contact members. The grounding contact ends **121***b* are referred to as a second grouping of contact ends **121**.

The grounding contact ends **121***b* are positioned adjacent to the differential-signal carrying signal contact ends **121***a*. The term "adjacent" may include neighboring in a same row and in a different row. In an embodiment, the grounding contact ends **121***b*, excluding the grounding contact ends **121***b* at both the right and left ends, are adjacent to the differential-signal carrying signal contact ends **121***a* both in the same row and in the different row. However, as discussed above, the signal contact ends **121***a* shown as white squares at both the right and left ends are not differential-signal carrying terminals, so the grounding contact ends **121***b* at both the right and left ends are adjacent only to the differential-signal carrying signal contact ends **121***a* in the same row.

In an embodiment, the contact ends **121** are positioned in two rows where two differential-signal carrying signal contact ends **121***a* and two grounding contact ends **121***b* alternate. The contact ends **121** are positioned such that the phases of the signal contact ends **121***a* and the grounding contact ends **121***b* alternate between the two rows so that the signal contact ends **121***a* and the grounding contact ends **121***b* face each other on different rows.

Since the pair of signal contact ends **121***a* carrying differential-signal are arranged so as to be surrounded by the grounding contact ends **121***b*, the shielding performance is improved so that crosstalk between adjacent differential signals is reduced.

In the embodiment of FIG. **3**, of the contact terminating ends **122** include two signal terminating ends **122***a* shown as a white rectangle, similar to the signal contact ends **121***a* shown as a white square, are positioned adjacent to contact members which are paired to carry a differential signal. In this regard, however, the white-rectangular signal terminating ends **122***a* positioned at both right and left ends, like the signal contact ends **121***a*, are connected to the signal contact ends **121***a* at both the right and left ends, respectively, and are optionally used for carrying a low-speed signal other than a differential signal, or used as a ground terminal, a power terminal, or other similar applications known to those skilled in the art. Of these white-rectangular signal terminating ends **122***a*, the differential-signal carrying signal terminating ends **122***a*, excluding the two contact members positioned at both the right and left ends, are referred to as a first grouping of signal terminating ends **122***a*.

In an embodiment, hatched-rectangular grounded terminating ends **122***b* are connected to the grounding contact ends **121***b*, and used for ground connection. These grounded terminating ends **122***b* are referred to as a second grouping of grounded terminating ends **122***b*.

In the above described embodiment, paired signal terminating ends **122***a* and paired grounded terminating ends **122***b* are alternately arranged.

In another embodiment, in comparison of the number of contact ends **121** with the number of contact terminating ends **122**, the white-square signal contact ends **121***a* and the white-rectangular signal terminating ends **122***a* are the same in number. However, the number of hatched-square grounding contact ends **121***b* is eighteen in FIG. **3**, while the number of hatched-rectangular grounded terminating ends **122***b* is nine. That is, the number of grounded terminating ends **122***b* is reduced to half the number of grounding contact ends **12** lb.

This allows the contact terminating ends **122** to be arranged with predetermined pitches, and further achieves a reduction in overall dimensions of the electrical connector.

In the above embodiments, signal contact ends **121***a* shown as a white square and the signal terminating ends **122***a* shown as a white rectangle are the same in number, and are connected to each other on a one-to-one ratio. That is, the signal contact ends **121***a* and the signal terminating ends **122***a* are connected to each other one by one.

However, all of the grounding contact ends **121***b* and grounded terminating ends **122***b* in the above embodiments are connected to each other.

In an embodiment of FIG. **4**, the signal carrying contacts **12***a* are differential-signal carrying contacts. Although FIG. **4** shows two signal carrying contacts **12***a*, only one signal carrying contact **12***a* is disposed at each of the right and left ends, and used for a purpose other than for carrying a differential signal, as described above with reference to FIG. **3**.

Further, as described with reference to FIG. **3**, the differential-signal carrying signal contact ends **121***a* and signal terminating ends **122***a* are connected to each other on a one-to-one basis via the signal carrying contacts **12***a*. The signal contact ends **121***a* may include a plurality of contact members, but the signal contact ends **121***a* are connected to the signal terminating ends **122***a* on a one-to-one basis.

Additionally, the signal carrying contacts **12***a* are positioned along an upper and a lower row, namely, in a row proximate to the circuit board and in a row distal to the circuit board (see FIG. **6**). Therefore, the signal carrying contacts **12***a* include a signal carrying contact **12***a* having a longer leg and a signal carrying contact **12***a* having a shorter leg on the contact terminating end **122**. In the embodiment of FIG. **4**, the signal carrying contacts **12***a* having the shorter legs are posi-

tionable in the row proximate to the circuit board. The signal carrying contacts **12***a* positioned in the row distal to the circuit board has structure same as the signal carrying contacts **12***a* shown in FIG. **4**, except the length of the leg is longer.

In the embodiment of FIG. **5**, the first grounding contact **12***b* is a ground-connection contact. The grounding contact ends **121***b* are positioned along upper and lower two rows on the mating end, shown in FIG. **1**, of the first grounding contact **12***b*. As described in the embodiments above, two grounding contact ends **121***b* are positioned on each wider-plate-like portion, such that two ground-connection contacts of the mating connector come into contact with one plate-like portion. One grounding contact end **121***b* is positioned on each of the narrower plate-like members formed at both ends. The tongue **111** of the housing **11** is inserted into between these two rows of plate-like members so that these plate-like members are supported by the tongue **111** of the housing **11**. (See FIGS. **1** and **7**) In an embodiment shown in FIGS. **1** and **7**, nine grounded terminating ends **122***b* are formed at equal intervals.

The contacts **12** in the embodiments of FIGS. **6** and **7** are supported by the housing **11**, which is positioned in the electrical connector **10** embodiment shown in FIGS. **1** and **2**. Therefore, the connections between the contact ends **121** and the contact terminating ends **122**, and the connections between the contact ends **121** and the contact terminating ends **122**, as shown in the FIG. **3**, are maintained.

The electrical connector **10**, described above in the embodiments of FIGS. **1** and **2**, and having the plate-like contacts **12** described in the embodiments of FIGS. **4-6**, is a male contact.

In the embodiments of the electrical connector **10** of FIGS. **8-18**, the electrical connector **10** has substantially the same structure as the embodiments discussed above of FIGS. **1-7**. As such, only differences from the embodiments described above will be described below.

In the embodiment of FIG. **3**, all the grounding contact ends **121***b* and all the grounded terminating ends **122***b* are connected to each other.

In an embodiment of FIG. **8**, the grounding contact ends **121***b* and grounded terminating ends **122***b* are divided into a plurality of groups. The contact ends **121** are divided into groups **125**, each group **125** including a total of eight contacts ends **121** positioned in two rows. Each row includes four consecutive contact ends **121**. However, a contact end group **125'** at an end of the two rows cannot complete eight contact ends **121** and therefore has only four contact ends **121**.

The contact terminating ends **122** are divided into groups **126**, each group **126** including six consecutive contact terminating ends **122** positioned in two rows. A terminating end group **126'**, positioned at the same end as the contact end group **125'**, cannot complete six second contact members, and therefore has only three contact terminating ends **122**.

Taken together, the group **125** of eight contact members for the contact ends **121** and the group **126** of six contact members for the contact terminating ends **122** have four grounding contact ends **121***b* within one group **125** and the two grounded terminating ends **122***b* within one group **126** connected to each other. However, the contact end group **125'** and terminating end group **126'** have two grounding contact ends **121***b* within the contact end group **125'** that are connected to one grounded terminating end **122***b* within the terminating end group **126'**.

In the embodiment of FIG. **9**, a second grounding contact **22***b* replaces the first grounding contact **12***b* shown in FIG. **5**.

The second grounding contact **22***b*, described with reference to FIG. **8**, has a shape divided into separated groups.

While the second grounding contact **22***b* shown in FIG. **9** is referred to as a ground-connection contact, in one embodiment the plurality of second grounding contact **22***b* function as a ground-connection. However, in the embodiment of FIG. **9**, the second grounding contact **22***b* is not limited to serving as a ground-connection, but each may alternatively function as a power supply. Therefore, one skilled in the art would appreciate that for the embodiment of FIG. **9**, the second grounding contact **22***b* may be used in a variety of applications than that of the first grounding contact **12***b* described in the above embodiments.

In an embodiment of FIG. **10**, contact members are also divided into groups **125**, **125'**; **126**, **126'**, similar to the embodiment of FIG. **8**. However, where the embodiment of FIG. **8** has all the grounding contact ends **121***b* and grounded terminating ends **122***b* connected to each other within the same groups **125**, **126**, in the embodiment of FIG. **10**, connections are split evenly within one of the groups **125**, **126**, such that some of the four grounding contact ends **121***b* within one group **125** (three grounding contact ends **121***b* shown in FIG. **10**) are connected to one of the two grounded terminating ends **122***b* within one group **126**. In addition, the remainder of the four grounding contact ends **121***b* (the remaining one grounding contact end **121***b* shown in FIG. **10**) is connected to the remaining one grounded terminating end **122***b* of the two grounded terminating ends **122***b*. The contact end group **125'** and terminating end group **126'** at have an incomplete number of contact members, in the same manner as the embodiment of FIG. **8**, and the two grounding contact ends **121***b* within the contact end group **125'** are connected to one grounded terminating end **122***b*.

In the embodiment of FIG. **11**, a third grounding contact **32***b* replaces the first grounding contact **12***b* shown in FIG. **5**.

The third grounding contact **32***b* shown in FIG. **11** has a structure divided into groups and further divided into two subgroups within one group, as described above with reference to FIG. **10**.

The third grounding contact **32***b* is a ground-connection contact in the context of the above description, and all of the third grounding contacts **32***b* may be used for ground connections. However, the third grounding contact **32***b'* connecting one grounding contact end **121***b* and one grounded terminating end **122***b* on a one-to-one basis in other embodiments may carry a low-speed signal.

In the exemplary embodiments of FIGS. **4-6** and **9-11**, contacts are described having a plate-like portion against which a contact of a mating connector is pressed, resulting in an electrical connector **10** having male contacts.

However, FIGS. **12-18** disclose exemplary embodiments of an electrical connector **10** having female contacts. The embodiments of FIGS. **12-18** described below have contacts differing in shape from the contact in the various embodiments described above, but the relationship of electrical connection remains substantially the same as described above.

The signal carrying contacts **12***a* shown in FIG. **4** are male contacts, and when female contacts of a mating connector (not shown) are brought into contact with the plate-like portion of the signal carrying contact **12***a*, the female contacts are elastically deformed to engage the male contacts. In an embodiment of FIG. **12**, signal carrying contacts **42***a* are female contacts. The signal carrying contacts **42***a* engage with plate-like contacts of a mating contact (not shown). The signal carrying contacts **42***a* include signal contact ends **121***a* that are elastically deformed by the plate-like contacts of the mating connector, and the signal carrying contacts **42***a* hold

the plate-like contact under elastic contact. Similar to the signal carrying contacts **12***a* shown in FIG. **4**, the signal contact end **121***a* of the signal carrying contacts **42***a* may include a plurality of contacts, but the signal contact end **121***a* is connected to the signal terminating end **122***a* on a one-to-one ratio.

Similar to the embodiment of FIG. **5**, the signal carrying contacts **42***a* include signal carrying contacts **42***a* having longer legs and signal carrying contacts **42***a* having shorter legs on the signal terminating end **122***a* side (see FIG. **14**). The signal carrying contacts **42***a* shown in the embodiment of FIG. **12** are contacts each having a shorter leg of these two kinds of contacts.

In the embodiment of FIG. **13**, a fourth grounding contact **42***b* also has the same relationship of connection between contact members as the first grounding contact **12***b* shown in FIG. **5**, except that the fourth grounding contact **42***b* is a female contact. For example, the fourth grounding contact **42***b*, as described above with reference to FIG. **3**, includes the grounding contact end **121***b* connected with all the grounded terminating ends **122***b* to establish a ground connection.

In an embodiment of FIG. **14**, the signal carrying contacts **42***a* are positioned in combination with the fourth grounding contacts **42***b*, and an embodiment of FIG. **15** shows the contacts **42***a*, **42***b* positioned on a housing **41**. In FIG. **15**, the respective arrangements of the contact ends **121** and the contact terminating ends **122** of the contacts **42***a*,**42***b*, is the same as the connection between the contact ends **121** and the contact terminating ends **122** shown in FIG. **3**.

In the embodiment of FIG. **16**, an electrical connector **40** includes the housing **41** covered with a shield **43** made of metal. Cantilevered arm members **431** are formed in the shield **43**, and press against a shield of a mating connector (not shown), like the electrical connector **10** shown in FIGS. **1** and **2**.

In the embodiment of FIG. **17**, fifth grounding contacts **52***b* replace the fourth grounding contact **42***b* shown in FIG. **13**. The fifth grounding contacts **52***b* are divided into groups, as described above with reference to FIG. **8**.

The fifth grounding contact **52***b* has the same connection relationship between contact members as the grounding contact **22***b* in the embodiment described above for FIG. **9**, except that the fifth grounding contact **52***b* is a female contact, and is therefore not described further.

In the embodiment of FIG. **18**, sixth grounding contacts **62***b* replace the fourth grounding contacts **42***b* shown in FIG. **13**. The sixth grounding contacts **62***b* are divided into groups and further divided into two subgroups per one group, as described above with reference to FIG. **9**.

The sixth grounding contact **62***b* has the same relationship of connection between contact members as the third grounding contact **32***b* described above in the embodiment of FIG. **11**, except that the sixth grounding contact **62***b* is a female contact, and is therefore not described further.

What is claimed is:

1. An electrical connector comprising:

a plurality of contacts having

contact ends positioned in two rows, and

terminating ends positioned in one row; and

a first grouping of the plurality of contacts which includes units of two differential signal carrying contacts having signal carrying

contact ends connected to two signal terminating ends on a one to one ratio, and

grounding contacts positioned adjacent to the signal carrying contacts and having grounding contact ends connected to grounding terminating ends with a number of grounding contact ends being greater than a number of grounding terminating ends;

wherein two of the signal carrying contact ends and two of the grounding contact ends are alternately positioned in the two rows such that the signal carrying contact ends are surrounded by the grounding contact ends.

2. The electrical connector according to claim **1**, wherein the units of signal carrying contact ends and the grounding contact ends are positioned such that the phases of the signal contact ends and the grounding contact ends alternate between the two rows so that the signal contact ends and the grounding contact ends in opposing rows face each other.

3. The electrical connector according to claim **1**, wherein two grounding contact ends are positioned adjacent to the two signal carrying contact ends.

4. The electrical connector according to claim **1**, further comprising a second grouping of the plurality of contacts having the same composition as the first grouping.

5. The electrical connector according to claim **4**, wherein the two grounding contact ends of the first grouping are positioned adjacent to two grounding contact ends of the second grouping.

6. The electrical connector according to claim **5**, wherein the two grounding contact ends of the first grouping and the two grounding contact ends of the second grouping are alternately positioned.

7. The electrical connector according to claim , wherein all of the grounding contact ends and all of the grounding terminating ends are connected to each other.

8. The electrical connector according to claim **1**, wherein the contact ends are divided into a plurality of contact end groups.

9. The electrical connector according to claim **8**, wherein each contact end group has eight contact ends positioned in two rows.

10. The electrical connector according to claim **9**, wherein each row includes four consecutive contact ends.

11. The electrical connector according to claim **9**, wherein each contact end group is connected to six contact terminating ends.

12. The electrical connector according to claim **11**, wherein each contact end group includes four grounding contact ends connected to two grounded terminating ends, and four signal contact ends connected with four signal terminating ends.

13. The electrical connector according to claim **12**, wherein each contact end group includes four signal contact ends connected with four signal terminating ends.

14. The electrical connector of claim **11**, wherein each contact end group includes three grounding contact ends connected to a first grounded terminating end, and one grounding contact end connected to second grounding terminating end.

15. The electrical connector according to claim **14**, wherein each contact end group includes four signal contact ends connected with four signal terminating ends.

16. The electrical connector according to claim **1**, wherein the contact ends are male-type contact ends.

17. The electrical connector according to claim **1**, wherein the contact ends are female-type contact ends.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,306,339 B2
APPLICATION NO. : 14/512826
DATED : April 5, 2016
INVENTOR(S) : Izumi Hasegawa et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims:
In Column 8, line 31, Claim 7, "The electrical connector according to claim ," should read
--The electrical connector according to claim 6--.

Signed and Sealed this
Twenty-seventh Day of September, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office